Instrumentality. On the Construction of Instrumental Identity

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Abstract The musical instruments of the 21st century and those of earlier times differ in many respects, be it their appearance, their technical functionality, their playing technique, or their sounds. And as they have changed, so too have our understandings of what a musical instrument is. The lacking precision of the current notion of the instrument and its incompatibility with contemporary instrumental forms are consequences of a technocultural process that raises fundamental questions about the identity of the musical instrument: When (and why) is something a musical instrument—and when (and why) is it not? In order to grasp the slight differences between the yet-to-be-defined instrumental and the assumed other, it seems reasonable to speak of instrumentality when denoting this particular specificity that instruments are supposed to feature. The present contribution seeks to prepare the ground for a reflective discussion on the concept of instrumentality and the underlying theoretical problem by considering not only the differences, but also the similarities between traditional and electronic musical instruments. Using a couple of different approaches to and views on the concept and defining a number of criteria of instrumentality, it eventually yields a picture of musical instruments that connects the contemporary ones with those known for centuries.

1 Introduction

> If a traditional and relatively precise definition of 'instrument' excludes large areas of contemporary musical practice from our field of study, we might be better off with less precise alternatives. (Kvifte 2008, p. 56)

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The past century has witnessed a number of technological changes which resulted in far-reaching consequences for all realms of musical practice. In the context of music production, the processes of phono-graphy, electrification, digitalisation, and interconnectedness gave rise to a huge number of new musical instruments which differ significantly from those known previously. The usage of recorded sounds, the synthesis of sounds that are physically irreproducible, playing instruments that are purely virtual, or having instruments communicate among each other via a network, identify milestones in the history of musical instruments. Yet, at the same time, they blur the boundaries between something we are prone to call 'instrument' and other categories such as 'medium', 'system', 'configuration', 'machine'.

Many contemporary sound producing devices, and in particular those that consist of a whole set of different functional parts, some of which may be software or based on other kinds of media technology, raise the question—to spectators as well as to organologists and other theoreticians, and maybe even to some musicians themselves—of whether they are (still or already) musical instruments. Complaints about the rather boring appearance of laptop performers, for instance, are known well enough, and frequently they are combined with this admittedly simple, but by no means trivial question. What, then, *are* musical instruments in the 21st century, and how can they be recognised as such? What do they have in common with instruments such as a violin, a piano, or a trumpet, and what are the differences between them? What is their relation to other sound producing devices? What defines contemporary musical instruments as musical instruments?

In order to grasp that specific quality musical instruments are assumed to feature as distinguished from other sound producing devices (or 'non-instruments' in general) the concept of instrumentality has been used ever more frequently over the past couple of years. The present contribution explores the usage of this concept in some pertinent works, discusses its use for the study of contemporary musical instruments and works out a number of criteria that appear to be crucial for the construction of instrumental identity.

2 Musical Instruments versus Other Things

Any project that involves introducing a new concept or sharpening an introduced one must start out with one question: Why? If the term instrumentality shall denote something like the 'essence of the musical instrument', as that which defines a musical instrument as such, it will first have to be explained why such a concept should be needed. Why should it not be sufficient to define a musical instrument as, say, "*any object that produces sound*", just like several (musicological and general) encyclopaedias do, following Hornbostel's statement that "[f]or purposes of research everything must count as a musical instrument with which sound can be produced intentionally" (Hornbostel 1933, p. 129)?

There are (at least) two answers to this question that are both surprisingly simple. The first answer is: *Musical instruments are not the only things that are used to produce sound.* On the contrary, our world today is full of things that are used to produce sound but are no musical instruments. An iPod, for example, is something that is undoubtedly used to produce sound but normally isn't referred to as a musical instrument but rather as a playback device. A violin, however, is something that at least people familiar with Western music culture immediately recognise as an item belonging to the class of musical instruments.[1]

But it is not always equally easy to tell whether something is a musical instrument or not. Consider, for instance, the cases of other sound media, such as turntables, radios, or tape machines. If it were only about them being used to produce sound, then all of them would clearly be musical instruments. But then, how are we to categorise smartphones, tablets, and laptops? And finally, what about objects like saws, combs, and oil drums? All of these things are or have been used more or less often to produce sound in a musical context. However, all of them have originally been designed with another purpose: While the mentioned sound media have the original purpose of playing back previously recorded or receiving broadcast sound, smartphones, tablets, and laptops have multiple purposes and can, among other things, also be used to produce sound, and everyday devices such as saws, combs, and oil drums have an original purpose that has nothing to do with sound at all.

What can be immediately learned from these examples is that instrumentality, or simply being a musical instrument must not be understood as a property an object as such has or has not. Rather, it seems to result from using something in a particular way which we think of as instrumental. Consequently, an object is not per se a musical instrument (ontological definition) but it becomes a musical instrument by using it as such (utilitarian definition).

But there is something else that can be learned from these examples—and this is where we get to the second answer: *Musical instruments are more than only sound-producing devices.* As the above examples should have made clear, there are some objects we immediately recognise as musical instruments, while we can surely say of others that they are no musical instruments and of yet others that they are used as musical instruments more or less regularly. This means that we are able to order all of those objects according to their 'degree of instrumentality', and this is to say that, apparently, there are some objects that, to us, are more 'instrumental' than others. Why is that so?

One could assume that it might have to do with the different purposes these objects have been designed for and that, for instance, we recognise the violin immediately as a musical instrument because it has never been anything else than that for centuries, while a saw might be used for sawing much more often than for

[1]Interestingly, this clear distinction between musical instruments and playback devices is relatively new: as recently as in the 1930s, gramophones and phonographs, the playback devices of the time, were referred to as musical instruments (cf., e.g., Straebel 1996, p. 219).

making music. However, there are a lot of examples which suggest that the original purpose of the objects is only partly relevant in this regard. The original purpose of a radio, for instance, could perhaps best be described as receiving and displaying broadcast audio signals. But in the context of a composition like John Cage's *Imaginary Landscape No. 1* this very purpose is being used for another purpose, namely that to make music. As will be described later, the *intention* with which an object is used is undoubtedly something that plays a major role in the construction of instrumentality. But its *purpose* is something that is dependent on the intention of the person using it, and thus it is situational.

What is probably equally important, here, is the fact that some of these objects have undergone a long process of culturalisation as musical instruments, while others have not (yet). Culturalisation in this regard means that they have been used for the purpose of making (a more or less specific kind of) music regularly and for a long time in the context of a particular culture. The importance of this aspect becomes even clearer when considering some other examples. Most electronic instruments, for instance, are objects that are designed for the single purpose of being used as musical instruments. Still, probably only few people will recognise The Hands (Fig. 1, above) as a musical instrument (even if the earliest version of it is more than 30 years old) because it has never been sold commercially and for that reason hasn't been used widely.

The other two images show examples for instruments that are very common in other parts of the world but scarcely known to most people in Europe. They don't have any other purpose than being used to make music, still to many Europeans they could probably be just about anything: they don't *mean* anything to them because they are not *culturalised* as musical instruments in the cultural context that they are familiar with.

Subsuming, the answer to the question of why a concept denoting what defines a musical instrument as such should be needed is that the traditional definition of musical instruments as sound-producing devices is not sufficient any more—first, because musical instruments are not the only things that are used to produce sound and second, because they are more than only sound-producing devices. And this is to say that it is not at all easy to define what a musical instrument essentially is and that, in order to do so, we need to be able to tell what the difference between musical instruments and other sound-producing devices is.

3 Musical Instruments and Musical Instrument Concepts

This specificity of musical instruments as distinguished from other sound-producing devices is expressed by the concept of instrumentality, which, as the above considerations suggest, seems to be a graduable and dynamic concept that is not tied to an object per se but is rather a matter of cultural negotiation. Yet, another important question remains to be answered: Why should we *want* to define what a musical instrument is? This entirely legitimate question is often

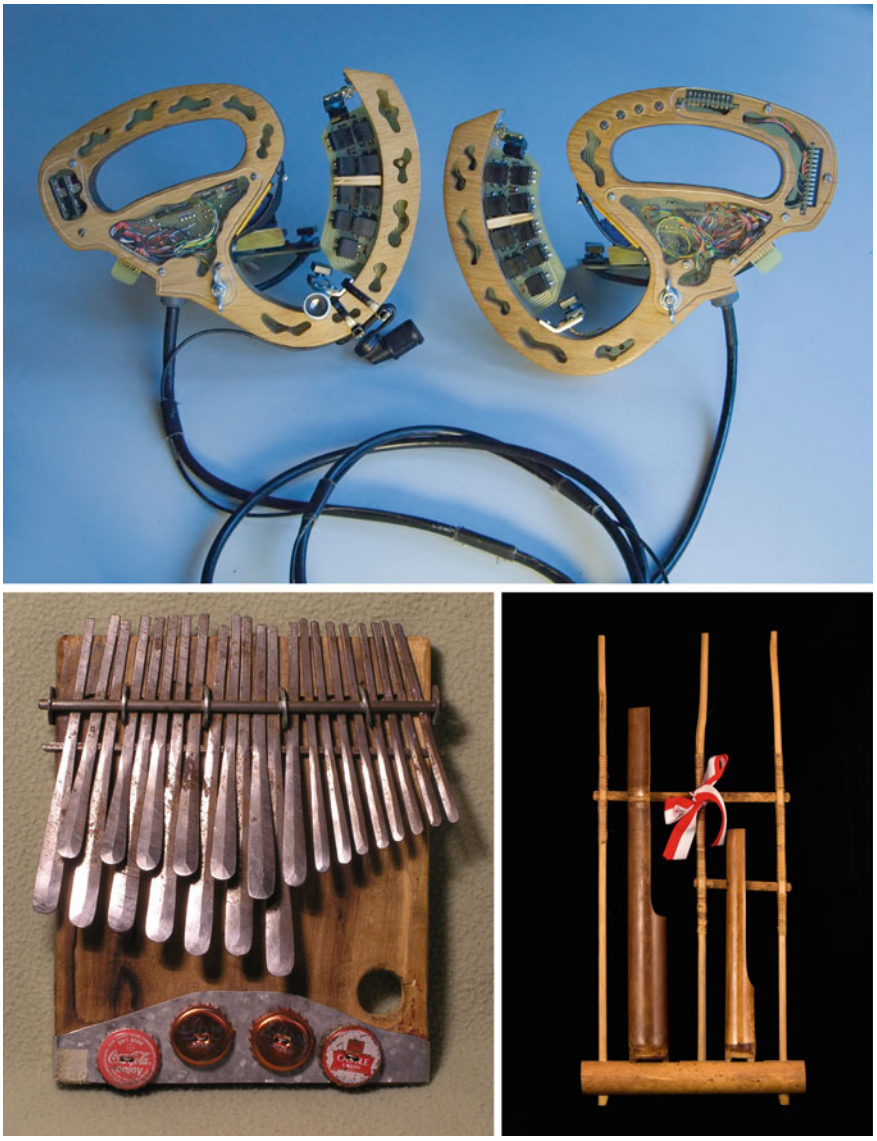

Fig. 1 Whether something is recognised as a musical instrument or not is not least a matter of culturalisation. The Hands (*above*) by Michel Waisvisz are a prominent example for an early gestural controller. The Mbira (*left*), widely distributed in Africa, is played by plucking its tines with the thumbs. Angklungs (*right*) are single-pitch instruments made from bamboo that are used in the context of traditional music in Indonesia

accompanied by the comment: *A musical instrument doesn't become one by calling it an instrument but by using it as such.* But what, then, does it *mean* to use something as a musical instrument? What are the actions typically associated with musical instruments? And what, other than that, constitutes a musical instrument as such?

Answering these questions may contribute to a better understanding of contemporary musical practice in general and of the way technocultural processes like electrification, digitalisation, virtualisation and the like have influenced the design and use of musical instruments in our culture. The repeated questions of whether something is a musical instrument or not indicate that fundamental cultural concepts are in transition—once again. Taking a look at the many different musical instrument concepts to be found in the recent literature, this becomes all the more visible.

It doesn't take much effort to find as many as six different musical instrument concepts already in a small selection of sources, which particularly show the degree of disagreement on the precise extension of the notion of musical instrument. Roughly a century ago, von Hornbostel and Sachs (1914) have established the traditional organological definition of musical instruments as *sound generators*. Recently, Harenberg (2012) has applied that concept to virtual instruments and claims that, consequently, in configurations of a *software sound generator* and a hardware controller interface only the former one is the instrument. Bense (2012), in contrast, argues that, in virtual instruments, it is the *interface* that is equivalent with the instrument. This view is also supported by the title of the NIME (New Interfaces for Musical Expression) conference, which deals with topics centred on digital musical instruments. A common definition of digital musical instruments conceives them in accordance with Malloch et al. (2006) as *tripartite systems* consisting of a sound generator, a control interface, and the mapping that defines how one is connected to the other. Enders (1987) has described musical instruments as *quadripartite systems* consisting of discrete modules for the generation, control, modification, and storage of sound and explicitly includes automatically controlled systems. Accordingly, Großmann (2010) discusses the status of *reproduction media* as musical instruments.

This list is, of course, only exemplary, but it illustrates quite appropriately why re-negotiating the concept of musical instrument should matter: There is anything but a consensus on what a musical instrument actually is, and the situation gets particularly complicated when it comes to contemporary instruments. Consequently, a definition referring to both traditional and electronic or digital musical instruments is yet to be made.[2]

In this context, a concept that is able to capture the common essentials of musical instruments could be of use. And that is where the notion of instrumentality comes into play.

[2]Tellef Kvifte's 1989 book has made a promising attempt in this regard, but in the meantime the situation has changed significantly through the advent of digital musical instruments (Kvifte 1989).

4 Previous Approaches to Instrumentality

In his 1987 article entitled "Instrumentalities", Burrows (1987) discusses the relation between the musical instrument and its player, thereby addressing some of what he considers characteristic, if not defining features of the musical instrument. Instead of denoting a specific instrumental quality, the concept of instrumentality, here, is used to describe the purpose of musical instruments, yet his ideas reflect exactly what the present reading of the term is supposed to stand for: the elements that constitute a musical instrument.

The most important feature of musical instruments, in his opinion, is their role as *mediators* between the performer's body and the sound they produce, or, between the inside and the outside of the human body (ibid., p. 117). He is interested in the transitions between the physicality of the human body and the sounding body of the instrument on the one hand and the volatility of the realms of sound and music on the other and seeks to apply the concept of "transitional object" to musical instruments (p. 120ff).

Burrows' understanding of instrumentality (in the sense intended here) is very clearly dominated by the function of musical instruments as mediators between apparently contrary realms, namely between corporeality and fluidity, between the inside and the outside and between the material and the immaterial.

To him, musical instruments are both part of the human body and external to it, they are literally means of physical expression, and this exactly is what Burrows regards as their purpose or—in his sense of the term—instrumentality.

His considerations are taken up by Philip Auslander[3] who opposes to Burrows' idea of the instrument having "its own agency with which the musician must negotiate" the image of the ventriloquist's dummy which, similar to musical instruments, needs to be acted upon by a human in order to make a sound, while the illusion of it having some kind of agency of its own is crucial to the performance. Following an argument by Godlovitch (1998), he stresses the importance of the specific circumstances under which instrumental sounds are produced: other than the mere production of particular sounds, he claims, instrumental performance involves techniques of producing them that are supposed to appear difficult to outside observers. This relates to the popular idea that *effort* be a key feature of instrumentality—perceived effort, that is, not actual effort, as Auslander concedes.

Apparently, then, instrumentality is not so much a matter of actual playing skills, but rather of the demonstration or, as he puts it, "dramatizing" of such skills.

The subjects of effort and of demonstrated instrumentality are also present in John Croft's 2007 paper "Theses on Liveness" (Croft 2007), in which a number of "conditions of instrumentality" are defined—conditions that must be fulfilled so that an audience would recognise a given setup of live electronics as an instrument. These conditions can be roughly summarised as the claim that the relationship between a performer's actions and the resulting sound be as transparent as possible

[3]Cf. his contribution reprinted in the present volume.

to the audience. Interestingly, then, Croft identifies the perception of the system as an instrument with the perception of the performance as live. This sort of perceived liveness is closely related to what Auslander describes as the perceived difficulty of an instrumental performance. For this reason, Croft argues, it should be of interest to any musician to achieve the highest possible degree of instrumentality, and thus of liveness—because "there is nothing inherently interesting about the fact that a computer can generate a sound in response to a person's action; this is why the triggering of sounds using sensors is often dull – or, at best, merely interesting" (ibid., p. 65).

His main argument is that instruments are simply more interesting to watch for the audience and that that should be motivation enough for musicians to optimise the instrumentality of their live-electronics setup.

Apart from the transparency of the relationship between playing action and resulting sound, Croft emphasizes the importance of physical effort and expressivity, of a "unified expressive persona normally associated with a solo performance" (p. 63), for his concept of instrumentality, which he sees threatened by the disembodied sounds coming out of a loudspeaker.

Although his sound-aesthetical ideal might be a very specific one, his approach provides a good example for the prominent role that is assigned to effort in the context of instrumentality concepts.

In contrast, the argument made by Philip Alperson in his 2007 paper "The Instrumentality of Music" (Alperson 2007) takes an entirely different direction. Even though he doesn't use the term instrumentality with regard to instruments, but rather to music itself, he still makes some interesting points concerning his concept of musical instrument and thereby contributes to the present definition of the term. He starts by defining what he calls the commonsense view of musical instruments:

> Typically, we think of instruments as discrete, self subsisting material objects, intentionally crafted for the purpose of making music by performing musicians. (ibid., p. 38)

Discussing what role the aspect of intention or purpose plays for instrumentality, he finds that there are numerous examples for instruments that haven't been designed as musical instruments originally but still involve some kind of human intention, namely "the intention to use the object as a musical instrument." (ibid.)

Another characteristic of musical instruments Alperson questions is their being external to the human body. Many musicians are so intimately tied to their instruments, he argues, that "it is difficult to know where the instrument ends and the rest of the body begins" (p. 46). Finally, he stresses the importance of what he calls the immaterial features of musical instruments. Being "musically, culturally, and conceptually situated" (p. 42), they cannot be fully understood if they are reduced to mere material objects—as it is usually done in traditional organology. Instead, they have to be studied in the context of their cultural and historical embeddedness.

In a recent study on the instrumentality of "new digital musical devices", Cance et al. (2013) have combined a linguistic analysis of the concept of musical instrument with an interview study, in which a number of experts had to give their

personal definitions of musical instruments. The authors summarise their findings in the statement that "it appears that "*instrument*" does not actually refer to a device […] but rather qualifies its interaction with users […]" (ibid., p. 297). In their opinion, instrumentality is not so much dependent on the properties of a device itself, but rather on the actions and meanings it is embedded in. This view again turns the focus away from the instrument as a material object and upon what Alperson calls its immaterial features.

5 Criteria of Instrumentality: A Preliminary Inventory

At the beginning of this chapter, instrumentality has roughly been defined as 'that which defines a musical instrument as such', as 'the essence of the musical instrument', and as a 'specific instrumental quality'. More precisely, it denotes the potential for things to be used as musical instruments or, yet differently, their instrumental potential as such. Instrumentality in this sense represents a complex, culturally and temporally shaped structure of actions, knowledge, and meaning associated with things that can be used to produce sound. However, as also suggested by the findings of Cance et al., the term must not be understood as denoting a property an object per se has or has not, but it is rather intended as a means of capturing the instrumental potential of a given artefact. Also, it must not be conceived as a constant, but rather a graduable, dynamic term which means that an object may be more or less instrumental, according to its expression of the characteristics associated with instrumentality.

A brief analysis of the above-presented works may serve as a starting point for the identification of those characteristics or criteria that are crucial for the construction of instrumentality. The following list represents only a first, rough approximation to those cornerstones of instrumentality. However, the cited references show that there are numerous examples in contemporary musical practice and current research suggesting that the mentioned criteria do actually matter for the construction of an instrument's identity. Those criteria that appear repeatedly and thus presumably play a major role are the following:

1. **Sound Production**

Obviously, musical instruments necessarily have to be able to produce sound in some way. This criterion represents the traditional musicological notion of instrument originating from von Hornbostel and Sachs (1914) and is—quite reasonably—neither questioned nor emphasized by any of the mentioned works. In digital musical instruments, however, the instrument's sound is not an immediate result of the sonic characteristics of a material object anymore, as is the case with traditional instruments. This means that, in the design of novel digital instruments, the instrument's sonic identity and its physical appearance have to be designed independently from each other. While there is quite a large amount of works dealing with physical

interface design, most prominently represented by the NIME community,[4] relatively little attention has been given so far to questions regarding the sound design of digital musical instruments.

2. Intention/Purpose

As already suggested by the original meaning of the Latin *instrumentum* ('device' or 'tool'), intention and purpose are quite decisive features for the construction of instrumentality in that playing a musical instrument always requires both the intention to do so and the purposeful use of something (that may also have a different original purpose) as a musical instrument. This criterion is particularly mentioned by Alperson, who addresses the relevance of intention for the process of instrument building.

Furthermore, as McCaleb (2014, p. 83) points out, it is also important on a performative level: with regard to ensemble performance, he states that "performers' musical intentions influence, to varying degrees, the way they […] operate their instruments. In performance, there is a correlation between intention […] and action […]." This correlation becomes particularly obvious when considering instrumental borderline cases such as the turntable, that allow for both an instrumental and a non-instrumental use. Here, it is primarily the performer's intention that makes the difference between the two.[5]

3. Learnability/Virtuosity

Both learnability and virtuosity involve the opportunity to improve one's playing skills through exercise. In a broader sense this means that the higher the impact of practising an instrument, the higher its degree of instrumentality. The idea of developing specific instrumental techniques over time is also congruent with the idea expressed by Auslander that, at least in professional instrumental performance, playing an instrument should appear more difficult than pressing a play button.

Such a demonstration of playing skills can directly be connected to Cohen's (2008, p. 58) idea of virtuosity, which he defines as "the exhibition of something difficult done without apparent effort." Monteiro (2007, p. 316) takes it even further and declares, "[v]irtuosity also means the possibility to bypass some kind of impossibility […], to go beyond reality, to cheat triviality."

This moment of bypassing the impossible is, according to Hegel (1975, p. 958), the very moment the instrument comes to life: "In this sort of execution we enjoy the topmost peak of musical vitality, the wonderful secret of an external tool's becoming a perfectly animated instrument […]."

In order to make this happen, however, the instrument has to be learned first. In a paper investigating possible reasons for the success or failure of newly designed digital instruments, Jordà (2004) has identified learnability and playability, but also

[4] A good overview is given in Marshall (2008).

[5] Such cases also exemplify the relevance of a specific instrumental sort of acting on something in order to make it an instrument.

effort, as determining an instrument's "efficiency"—a term he uses to express the correlation between the time needed to learn an instrument and the acquired playing skills.

But especially when it comes to digital instruments, the learning process can be challenging and quite different from that known from traditional instruments. This is, on the one hand, due to the fact that electronic instruments usually lack visual or haptic feedback, which makes them more difficult to play. On the other hand, their learning procedures and playing techniques are not yet standardized and often must be developed first.

Several efforts have been made to facilitate the learning of such instruments by means of technical innovation. Jordà (2003), for instance, has shown how the implementation of visual feedback can improve the learnability of an interactive music system. Merrill and Paradiso (2005) have gone further by transferring part of the learning task to the instrument itself, so as to teach the instrument the desired mappings by example. However, novel instruments are still inadequately integrated into institutional music education, although students, teachers, and instrument designers would probably benefit alike.

4. **Playability/Control/Immediacy/Agency/Interaction**

Although these are actually five quite different notions, they share some common features that are mentioned both by Auslander and Croft as well as by Cance et al. The requirement that a musical instrument be playable may be seen as a somewhat broader expression for the traditional idea of the instrumentalist controlling the instrument. Both playing and controlling an instrument involve immediacy regarding the connection between the instrumentalist's actions and the instrument's sound, but they differ in the degree of agency they ascribe to the instrument. In this regard, interaction can be understood as a concept of instrumental play that ascribes as much agency to the instrument as it does to the performer.

The question of how electronic and digital musical instruments should best be controlled has been—and still is—one of the key issues in the pertaining academic discourses for quite a while now. As early as 1991, Joel Ryan from the Studio for Electro-Instrumental Music (STEIM) in Amsterdam has problematised the "mediating distance which confronts each composer when encountering the computer" and proclaimed a "quest for immediacy in music" (Ryan 1991, p. 3) for both aesthetical and practical reasons. A few years later, Levitin et al. (2002) were among many who, in a similar way, expressed their displeasure with the persistent dominance of the keyboard metaphor in electronic musical instruments.

There was not exactly a lack of suggestions of how to solve the interface problem—but many things had to be considered that were unknown in traditional lutherie.

The interaction with musical instruments had to be thought anew, lessons had to be learned from HCI (Holland et al. 2013), from the other performative arts (cf., e.g., Benford 2010), as well as from the newly formed discipline of interaction design (e.g., Franinovic and Visell 2007).

Although playability did (and does) play a role, for instance, in violin making in the sense of how to improve responsivity and ease of play through particular constructional measures, in the context of HCI, playability issues gain a whole new meaning. Thus, for example, in a playability evaluation of a virtual bowed string instrument (a virtual violin interface, that is), playability means that "the acoustical analysis of the waveforms produced by the model fall within the region of the multidimensional space given by the parameters of the model" (Young and Serafin 2003). Analogously, numerous PM-modeled instruments have been subjected to playability evaluations in order to allow for a latency-free, reliable, and authentic-sounding real-time play (cf., e.g., Vergez and Tisserand 2006).

Ever since Joel Ryan's call, there have been innumerable approaches to establish alternate forms of control in musical instruments, ranging from gestural and biosignal control (see Miranda and Wanderley 2006 for an overview) over feedback control (e.g., Berdahl et al. 2012) to shared control (e.g., Gurevich 2014), where part of the control is transferred to the instrument itself.

In this context, the idea of musical instruments having their own agency (Bates 2012) has become a popular and much-discussed topic, in artistic programs (Jenkinson 2004; de Campo 2014) as well as in theoretical discourses (Kim 2007; Magnusson 2009).[6]

5. Expressivity/Effort/Corporeality

These three, too, represent fairly different concepts all of which, however, address the physical aspect of instrumental performance. The claim that playing an instrument require physical action or even effort, mentioned by Burrows, Auslander, Croft, and Alperson, goes back to the romanticistic idea of the (both physically and aesthetically) expressive play of the virtuoso and is becoming ever more popular again in the context of contemporary instrument building.

The variety of current works investigating the function and meaning of gestures, tactility, ergonomics and the like in the context of musical instruments (e.g., Wanderley and Battier 2000; Godøy and Leman 2010) shows how the physical aspects of instrumental practice are being brought back to the fore after having been ignored in the study of musical instruments for quite some time.

That a musical instrument is a means of musical expression and should therefore enable an expressive play is largely uncontested. Therefore, one of the main goals of contemporary musical instrument design is to find ways of creating instruments that inherently allow expressivity, for instance, by means of transparent mappings (e.g., Fels et al. 2002). However, as Malloch et al. (2006) note, "[e]xpressivity is commonly used to discuss the virtue of an interaction design in absolute terms, yet expressive interfaces rely on the goals of the user and the context of output perception to generate information." This problem is also addressed by Arfib et al. (2005), who explore how expressiveness can be obtained by performing specific gestures.

[6]See also Philip Auslander's contribution in this volume.

The idea of expressivity is often mentioned in connection with effort, a pairing that is known from traditional instruments. This appears to be in contrast to the effortless play of electronic instruments, as D'Escriván (2006, p. 183) notes, not without stating, however, that "a young generation seems content to accept that there may be no apparent correlation between input effort and sound output."

6. **"Immaterial Features"/Cultural Embeddedness**

The cultural embeddedness of an instrument or its "immaterial features" are particularly emphasized by Alperson and Cance et al. Whereas Alperson stresses the significance of an established instrument's cultural situatedness for its instrumental status, Cance et al. especially refer to the importance for a new instrument to take up existing aesthetical practices.

In a similar way, Dawe (2003, p. 274) has pointed out that the "value and meaning [of musical instruments is] negotiated and contested in a variety of cultural arenas" and that, apart from studying its physical functionality and its location in the organological system, an instrument's identity cannot be fully understood without studying the cultural contexts in which it is embedded. Despite this being a key issue in ethnomusicology, as is impressively demonstrated, e.g., by Kartomi (1990), still it is all too often forgotten in the study of contemporary musical instruments.

7. **Audience Perception/Liveness**

Meeting the audience's expectations, be it with regard to the difficulty of the performance, its liveness or its expressiveness, seems to be a criterion that should not be underestimated. Following the arguments of both Auslander and Croft, instrumentality in the sense of a category that legitimates instrumental performance is highly dependent on audience perception.

To date, the role of audience perception has not received much attention in the study of contemporary instrumental performance. Only recently have some works addressed the connection between audience perception and the evaluation of novel digital instruments (e.g., Barbosa et al. 2012; Brown et al. 2013). Following this idea, Gina Emerson's contribution to the present volume illustrates how much transparent mappings matter for the audience's perception of instrumentality.

As also stated by Croft, the perception of instrumentality is directly connected with the perception of liveness. Ever since Philip Auslander's 1999 book on liveness (Auslander 1999), the term has become increasingly popular and still inspires a significant amount of works in the field. Lately, there has been a number of attempts to capture the perceived liveness of digital musical instruments, e.g. Marshall et al. (2012), Bown et al. (2014) and Berthaut et al. (2015).

6 Conclusion

The aim of this chapter was to introduce the concept of instrumentality, discuss its use for the study of contemporary instruments, and define a number of criteria that, based on a literature review, appear to be crucial for the construction of instrumentality.

As such, they also identify those fields of research that scholars and designers need to pay particular attention to when studying and creating electronic and digital musical instruments that are not only technically appealing, but also artistically versatile, culturally meaningful and visually intriguing artefacts.

The study of contemporary instruments confronts us with a number of fundamental issues regarding the way of how instrumental identity is being constructed that cannot be answered without taking into account that musical instruments are a lot more than just arbitrary objects that produce sound. They are complex, culturally freighted artefacts allowing for particular ways of interaction that result in particular sounds. Their identity as musical instruments—their instrumentality—is constructed in the interplay of various criteria, among the most relevant of which seem to be those mentioned above. If the underlying principles of this interplay were better understood, they could inform the design process of new musical instruments and thus contribute to the development of instruments with a characteristic and coherent identity. But above all, they would provide general insights about how processes of culturalisation work: how arbitrary objects turn into meaningful things with a well-determined function—such as, for example, musical instruments.

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